Quantum Computing Seminar Series
Joint with Electrical and Computer Engineering Colloquium

February 21, 2020

3:00 PM – 3:50 PM

Electrical and Computer Engineering | Room 101

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Catching a Quantum Jump Mid-Flight: A Quantum Trajectory Perspective

ABSTRACT

Quantum jumps of single trapped ions were observed in the seminal experiments of the Dehmelt, Wineland, and Toschek groups in the mid-1980's. This observation marked a pivotal point in the understanding of quantum open systems and appeared to settle the debate between discrete and continuous transitions in quantum systems. The idea behind these experiments was seeded in Dehmelt's electron shelving configuration, where the fluuorescence of a driven two-state system is abruptly interrupted as the system transitions to a third state. The transition to the metastable state is then inferred from the lack of fluoresence photons, a sequence of "nothing-happened"-events or null measurements. These measurements, however, provide the system with a new time-scale in which the transition might occur as a continuous process, as pointed out by Porrati and Putterman shortly after the first observations of quantum jumps.

Null-measurements are a cornerstone of quantum trajectory theory, a theory developed for the study of measured quantum systems. In this talk we review the electron shelving scheme using a quantum trajectory simulation. The results display a continuous and coherent transition of the electron as it shelves into the metastable state. These findings are supported by recent experimental results using a superconducting circuit architecture.

Biography

Ricardo Gutiérrez-Jáuregui is a post-doctoral fellow at Columbia University. Previously, he was a post-doctoral fellow at Texas A&M University. He has a BSc and a MSc from Universidad Nacional Autonoma de Mexico. He has a PhD in physics from the University of Auckland, in New Zealand, where he worked with Professor Howard Carmichael.

His research topics include elementary processes in light-matter interactions, dissipative quantum phase-transition, structured light, and the description of novel systems using quantum trajectory theory.